THE STREET RAILWAY JOURNAL

Vol. XI. NEW YORK & CHICAGO, MARCH. No. 3.

THE STREET RAILWAY SYSTEM OF BUFFALO.

Buffalo, "the Queen City," is well located for the successful operation of a street railway system. Situated at the eastern end of Lake Erie, and at the terminus of the Erie Canal and a large number of important trunk railroad lines, the facilities for the receipt of fuel are excellent. The city has become, through these and other favorable causes, a large manufacturing center, and is growing rapidly in population and wealth. The development of electric power on an enormous scale from the water power of Niagara, and its transmission to Buffalo, is a certainty of the near future and will have an important bearing on the development of the city.

The city resembles in shape an outspread fan, and the street railway lines radiate from the business district of the city, which is unusually small in area. The total area of the city is large, however, and the street railway traffic is at present very large and is constantly on the increase.

Within the past two years five suburban electric railway lines have been constructed, each of which terminates at the city line of Buffalo, making connections with one of the many limits of the Buffalo Railway system. These are the Buffalo & Tonawanda Electric Railway connecting at Tonawanda Street; the Buffalo, North Main St. & Tonawanda Electric Railway and the Buffalo & Williamsville Electric Railway connecting at North Main Street; the Delaware, Elmwood & Tonawanda Electric Railway connecting at the Military Road, and the Buffalo, Bellevue & Lancaster Electric Railway connecting at the city line at Broadway. While the Buffalo Railway system has no interest in these outlying lines, it can be easily understood that it welcomes them as feeders to its already existing system.

In addition to the suburban lines above mentioned, there are three more proposed lines. One between Buffalo and Niagara Falls, one between Buffalo and Hamburg, and one between Buffalo and Elliottsville and Ebenezer.

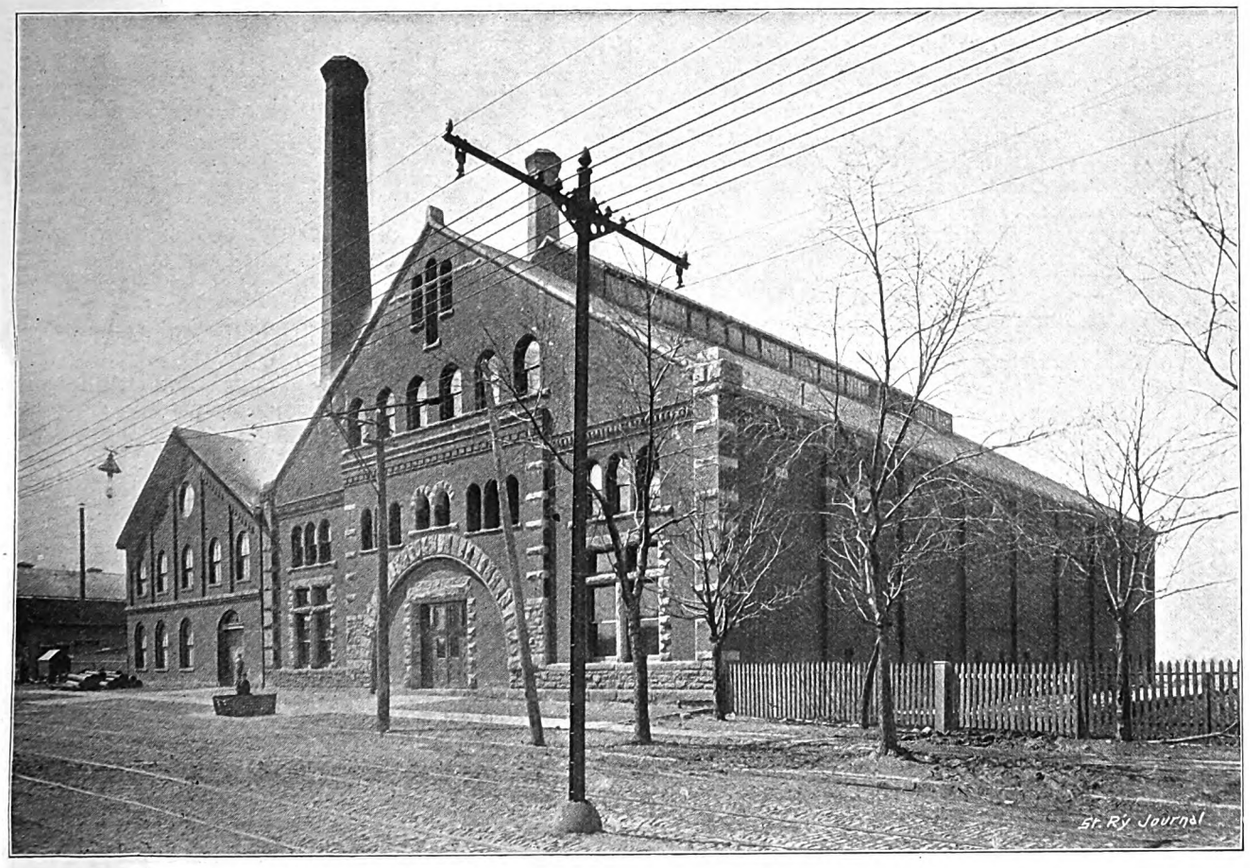

FIG. 1.—EXTERIOR OF POWER STATION—BUFFALO STREET RAILWAY CO.

POWER STATION.

The power station of the company is of brick with stone trimmings and iron truss roof, and is located on Niagara Street just beyond old Fort Porter. It consists of two separate and distinct buildings, both fireproof throughout. The engine house measures, inside dimensions, 86 ft. 11 ins. × 143 ft. 10 ins. It was erected during the spring of 1891, and at that time was considered the finest and the largest in the country. There are no windows at the sides of the building, but plenty of light and ventilation are provided by those at each end and by the monitor roof. At night the station can be lighted by 350 incandescent and eighteen arc lamps. An electric traveling crane of twenty-five tons capacity, built by the Kellogg Iron Works, of Buffalo, N. Y., and operated by a five horse power stationary motor, runs the entire length of the building.

ENGINES, GENERATORS, ETC.

The engine equipment is specially interesting from the fact that this company was one of the first to introduce vertical engines of the marine type. These have given such excellent satisfaction that any additions to the present equipment will be of this type and direct connected. The large engines, shown in the rear of Fig. 4, are of 1,250 H. P. each, with cylinder dimensions 20 and 44 ins. by 36 ins. stroke, and were built by the Lake Erie Engineering Works, of Buffalo, N.Y. There are also contained in the station six 600 H. P., compound, condensing engines, of the Lake Erie type, with cylinder dimensions of 17 and 33½ ins. by 28 ins. stroke, and three Ball 300 H. P. engines.

The generator equipment illustrates in a very striking way the changes in current practice during the last four years, the first equipment consisting of nine 200 K. W. generators, of the Edison bipolar type, the next equipment six 200 K. W. Thomson-Houston four pole machines, and the latest two General Electric 800 K. W., direct connected.

As will be seen, all steam piping is carried under the floor, and no impediment is offered to the free use of the traveling crane.

CONDENSERS AND PIPING.

The station's condenser and pumps are located in a special room, whose floor is forty-five feet below that of the engine room. The station can also be run non-condensing, and is usually so operated during the early morning hours when the load is light, to give a chance to clean the condensing apparatus, inspect it, etc. The well is ten feet in diameter and twenty-five feet deep, and the water for condensing is drawn from the Erie Canal, 200 ft. away. The type of condenser employed is the Worthington. The live steam pipes are also tapped wherever necessary, and the water of condensation is returned to the boilers by a Snow pump located with the boiler feed pumps above the condenser. In case of any accident to the condensing apparatus an automatic valve is arranged in the exhaust pipe, so that as soon as the pressure in the exhaust main gets one and a half pounds above atmospheric pressure, connection with the exhaust head is made, so that the engines will operate non condensing.

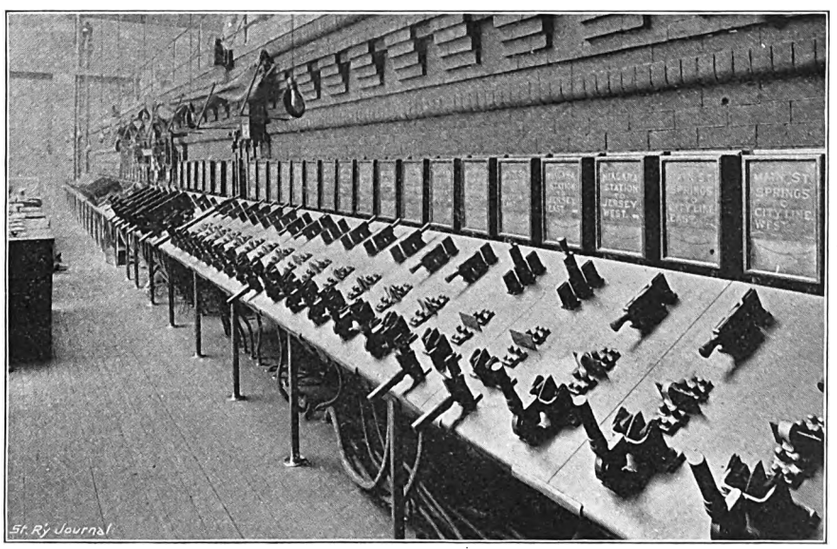

FIG. 2.—SWITCHBOARD GALLERY—BUFFALO STREET RAILWAY CO.

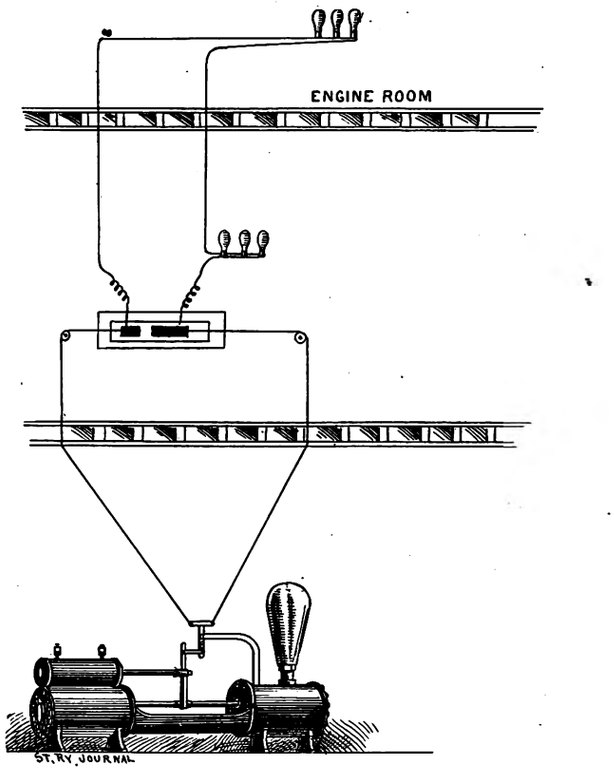

FIG. 3.—METHOD OF INDICATING CONDENSER STROKES—BUFFALO STREET RAILWAY CO.

An ingenious method is employed for keeping watch of the condenser pump without the employment of an attendant constantly in the condenser room. The pump piston, as shown in Fig. 3, is made to open and close a circuit in which are three lamps in the pump room and three others in the engine room. At every stroke of the pump the lamps flash brightly and remain dark during the return stroke. By this arrangement the engineer can detect any irregularity in the pumping without leaving the engine floor.

SWITCHBOARD AND ENGINE ROOM DETAILS.

The switchboard occupies an entire gallery at the north end of the station, and is shown in Fig. 2. It is a long, narrow, inclined slate table, and from this gallery the ordinary operation of the station is directed. A large dial of ground glass, thirty inches in diameter, is hung just above the switchboard in the middle of the gallery, where it can easily be seen from any part of the engine room. Upon one-half of the dial are numbers 1 up to 12 with the word "start." Upon the other half are the numbers 1 up to 12 with the words "stop." Each engine, of which there are eleven, is also given a number. When the operator at the switchboard notices that the demand for power on the line is increasing, and that it is necessary to start another engine, he indicates which engine

should be started by turning the hand of the dial to the proper number on the dial, and strikes a bell to call the engineer's attention to the fact. The engine is then started by the engineer, and as each engine is provided with a push button connected with a signal bell in the switchboard gallery, the engineer can indicate to the switchboard operator when the engine has been brought up to speed. When this is done its generator is thrown in from the switchboard. The same method is employed when the switchboard operator desires to cut out any engine. He calls the attention of the engineer by his gong, and indicates by the dial which engine is to be cut out. The dial is illuminated at night by three incandescent lamps which are placed behind it. This method avoids all necessity of calling from the switchboard gallery to the engine floor, with consequent confusion and liability to error.

A system of bell signals is also in use between the engine room and the boiler room, and between the engine room and the condenser room, one stroke indicating that an extra engine is about to be put in service, and two strokes that an engine is to be cut out. In this way the firemen can either increase their fires or get ready a new boiler, or else reduce the amount of steam being generated, and the man in the condenser room can be ready to supply more or less condensing water according to the conditions. A steam pressure indicator is also located in both the engine and boiler rooms, so that both engineer and fireman can notice any change in the pressure.

Another convenient, and as occasions might prove, exceedingly important feature of the engine room is that close to each engine is erected a wooden panel, upon which are attached all the wrenches required for that particular type of engine. If any changes should have to be made in a hurry, there need be therefore no confusion or difficulty in finding the right tool. Graphical records are kept of the station output from ampere and voltmeter readings taken at intervals of ten minutes throughout the twenty-four hours. The blanks used for this purpose also give a record for the day of the vacuum, number of boilers used, number of hours run under high pressure, usually from 1 A. M. to 5 A. M., and time and location of all short circuits. The heaviest load upon the generators is from 5 P. M. to 7 P. M, when it averages about 3,800 H. P., and in bad weather 5,000 H. P. The following table gives

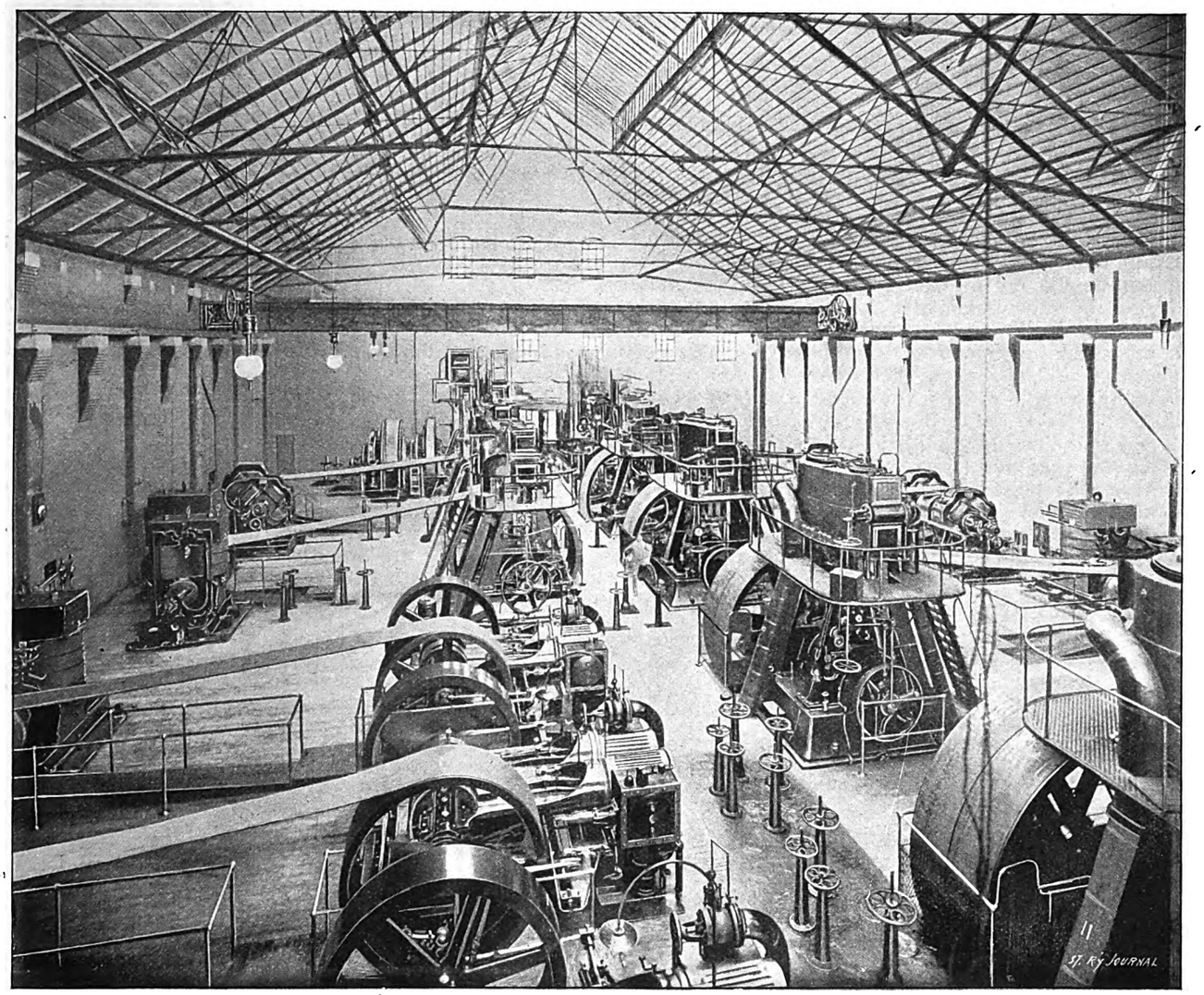

FIG. 4.—INTERIOR OF ENGINE ROOM—BUFFALO STREET RAILWAY CO.

the average electrical horse power developed during the six months ending Dec. 31, 1894, the number of cars in operation being about the same for each month:

July.....	1,426 E. H. P.	October.....	1,497 E. H. P.
August.....	1,503 E. H. P.	November....	1,601 E. H. P.
September....	1,541 E. H. P.	December.....	1,702 E. H. P.

Average for the six months 1,546 H. P.

BOILER ROOM.

The boiler room measures 55×180 ft., and contains at present eighteen Babcock & Wilcox boilers, equipped with Roney automatic stokers supplied by Westinghouse, Church, Kerr & Company. Arrangements are now being perfected and will be in operation within a month by which all handling of the coal will be automatic. Fuel is received from railroad cars which run upon a spur of the New York Central & Hudson River Rail-

road, directly in rear of the station. Hence it is conveyed by a bucket chain operated by an electric motor, to the storeroom immediately in the rear of the power station and having a capacity of of 2,500 tons. From this point it is raised by a second bucket conveyor, also operated by an electric motor, to the top of the boiler room, and thence by a mechanical belt to a hopper of five tons capacity.

From this hopper the coal is drawn into a second hopper of one ton capacity mounted on wheels, and running along elevated tracks in front of the boilers by means of electric power. This traveling hopper dumps directly into the stoker hoppers. An ash conveyor carries the ashes to the rear of the station, where they are dumped directly into cars and hauled away.

As will be seen, there is no handling of the coal required, all transportation being by mechanical means.

STREET CONSTRUCTION.

TRACK.

The standard track construction of the Buffalo Street Railway is now a nine inch, ninety-four pound, half grooved rail. This is laid on yellow pine ties, measuring 9 × 5 ins. ×7 ft., and laid thirteen to each thirty feet. The ties are tamped with broken stone. Suspended joints are used, with twelve bolt fishplates and bolts one inch in diameter. The rails are laid with close joints, the rails being rammed together so as to make as close a joint as possible. In laying the rails care is first taken to brush off with a wire brush any scale which there may be on the rail or fishplate. The trackmen then tighten the fishplate bolts, first with a one foot wrench, then with a two foot wrench, and finally with a wrench four feet in length. Out of considerable track laid in this way last summer, only one joint was found to have pulled apart this winter. The distance between butts in this case was about two and a half inches, the bolts having sheared. A two and a half inch shim, of the same section as the rail, was driven between the two butts.

The rails are bonded through the base with channel pins and No. 0000 copper bonds, the rail being drilled two

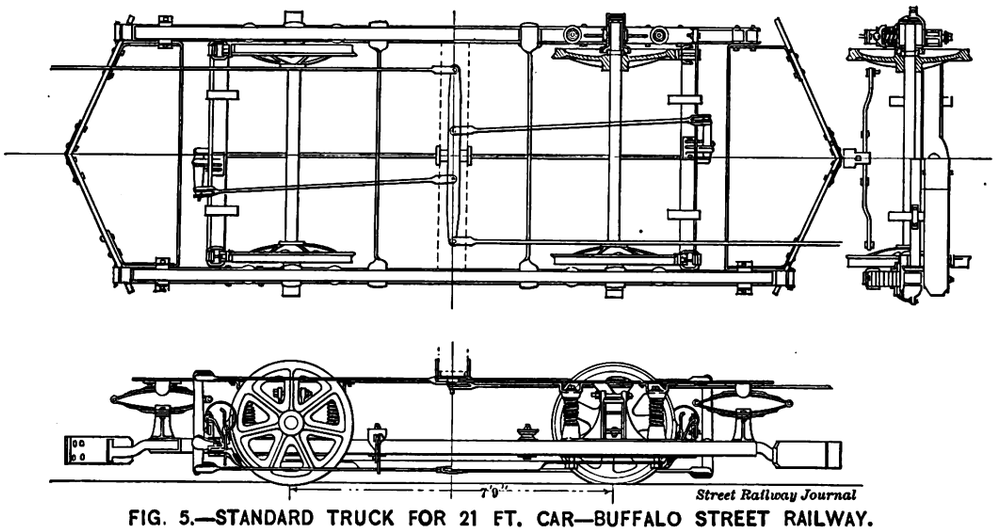

FIG. 5.—STANDARD TRUCK FOR 21 FT. CAR—BUFFALO STREET RAILWAY.

inches from the end. Tie rods have been used in former work, but for future construction tie braces five feet apart will probably be employed in their place.

FEEDER CONDUITS.

During 1891 and 1892, the company installed feeder conduits under about thirteen miles of street, and the conduits in all were able to contain about 100 miles of feed wire. Each conduit consisted of from four to twelve ducts. Two types of ducts were used, wooden pulp pipe, of the Indurated Fibre Pipe Company, and cement lined pipe, of the Standard Underground Cable Company. The method of construction was very similar to that employed in Philadelphia, and described in former issues. Briefly, the pipes were imbedded in cement, grouted, and terminate in manholes located about 400 ft. apart. All manholes drain into sewers, and all contain iron junction boxes similar to the standard Edison junction box. The feed wires in the cables are stranded, and are covered with double braided insulation which, in turn, is covered with lead, and over that is a second double braid insulation.

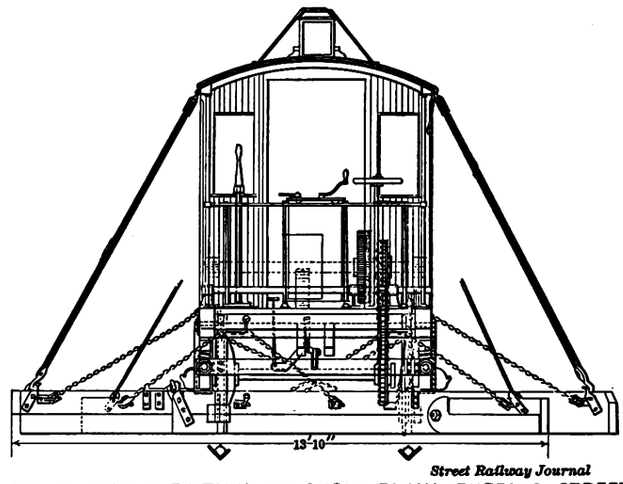

FIG. 6.—END ELEVATION OF SNOW PLOW—BUFFALO STREET RAILWAY.

All joints are lead wiped. To draw the cables into the ducts the latter are first threaded by rods. The return conductors are in some cases as large as 1,000,000 circular mils in section, and are connected at each manhole with the track rails. The underground feeder system has not given the company entire satisfaction, and no conduits have been installed recently.

The overhead construction is mainly of the span type, except on Niagara and North Main Streets where center poles are used, and iron plate Kellogg poles are employed. The feed wire, span wire and trolley wire are of different makes, those of the Standard Underground Cable Company and John A. Roebling's Sons Company predominating. The company has at present 140 miles of track, all of which are operated by electric power, the last horse car having been run November 10, 1894.

ROLLING STOCK.

The passenger rolling stock of the company consists of 362 cars, of which 281 are motor cars. The Niagara Street line, which was the first equipped with electric power, employs a double truck, vestibuled car, thirty-six feet over all. The company also has electric cars as short as sixteen foot bodies, being some of those formerly used with horses. The long, double truck cars seem well suited to the conditions on Niagara Street, where there is a "long ride" traffic. Most of the recently purchased cars, however, are twenty-one feet in body length with four foot platforms, and the general manager considers this size to be the one best adapted for ordinary conditions of service, and as long as can be well used with a four wheel truck. In fact, he believes that double trucks might perhaps be used with advantage under cars of this length. The makers represented are the J. G. Brill Company, J. M. Jones' Sons Company, Pullman Company and the Laclede Car Company, the latter company having supplied the recent bodies purchased.

The types of trucks used by the Buffalo Railway Company are Brill, Bemis and one of the company's own design, which is the one most largely employed. It is shown in Fig. 5, and, as will be seen, has the obvious

merits of simplicity and cheapness. It is built in the company's own shops. The side bars are of rolled steel separated by an I beam under each pedestal. The weight of the truck is 4,100 lbs. The brake gear is particularly simple, and employs but one turnbuckle, as will be seen.

General Electric motors are used throughout, the types being the S. R. G., W. P. and G. E. 800. Two registers are used on each car, the Railway Register Company's machines being employed. One register records the tickets and cash fares received, the other, the dial of which is colored red, is for transfers and three cent or half fares.

The company has thirty Genett air brake equipments on the Niagara Street line, and is will pleased with them. The first order for these brakes was for five equipments, and these gave such good satisfaction that, after a service of six or seven months, the other equipments were placed in position last Fall.

WHEELS.

The wheels employed are manufactured by the New York Car Wheel Works of Buffalo, and the company presents the excellent record of having broken no wheels this winter and flatted none since January 1.

The number of wheels used by the Buffalo Railway Co. for all renewals and repairs under its electric equipment from October, 1891, to December, 1894, is as follows:

300 lb. motor wheels	40
325 lb. " "	406
360 lb. " "	148
400 lb. " "	2
Total	596

or an average of less than 100 pairs of wheels per annum, covering all the wheel equipment during the period named.

As in 1894 the company carried 40,000,000 passengers, and a proportionate number in other years, it will be seen that the total expenses for wheels per annum were very small. Although the company has had some wheels with chipped flanges, due to running over steam railroad tracks, where the weight of the car had to be taken by the point of the flange, it has never had a broken wheel out of the total number furnished.

It is interesting to notice that not as many wheels flat with the air brake as with the hand brake, because the former can be set and released quickly in stopping a car, preventing sliding of the wheels. Another interesting point mentioned by the general manager is upon the use of sand as affecting the wear of wheels. With a considerable use of sand the wheels were found to wear rapidly. The sand is now applied but sparingly, and by a sand car instead of by each motorman, and the number of flattened and worn wheels has decreased to a marked extent.

MILEAGE.

The mileage run by the cars during the fiscal years ending June 30 was: 1892, 4,475,593; 1893, 6,454,289; 1894, 7,477,499.

SNOW EQUIPMENT.

While the snow storms in Buffalo are not apt to be as severe as in many cities in this country, the company believes in caring well for the removal of snow, and has an excellent equipment for this purpose. It consists of two General Electric sweepers, seven electric plows of the company's own make, sixteen trail snow plows, five Walkaway snow plows manufactured by the Fleming Manufacturing Company, of Fort Wayne, Ind., two Day four wheel plows, and Littell track scrapers attached to each car. A certain number of the operating force of the company, considered to be the most reliable and efficient, are designated the "snow gang." In pleasant weather

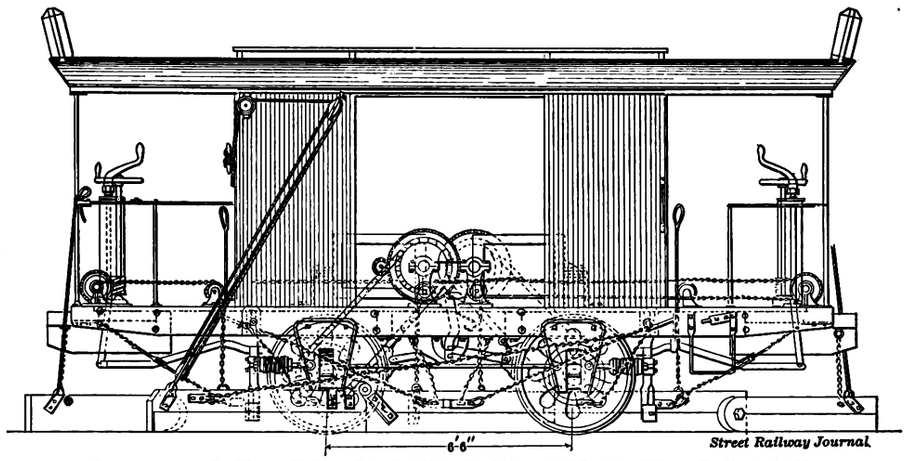

FIG. 7.—SIDE ELEVATION OF SNOW PLOW—BUFFALO STREET RAILWAY.

their duties are the same as other conductors and motormen, but in case of a snow storm they are put in charge of the snow fighting equipment. Their pay when on this duty is one-third more than when on ordinary service, so that prompt and efficient work is secured from them. During the storm of February 8 and 9, the drifts on some points of the Buffalo Railway Company's line were as deep as twelve feet, and on long stretches of the line snow to the depth of four or five feet was encountered, but by vigorous work the tracks were kept open and as good service was given as at any other times.

The company's own type of snow plow is shown in Figs. 6, 7 and 8. As will be seen, it does not differ materially from other plows, but all parts are easily accessible and all apparatus controlled from the front platform. The snow is removed by the mouldboard, whose effective length can be varied as shown, from the fact that it is hinged at the side of the car. Ice on the tracks can be removed by diggers held by springs against the track.

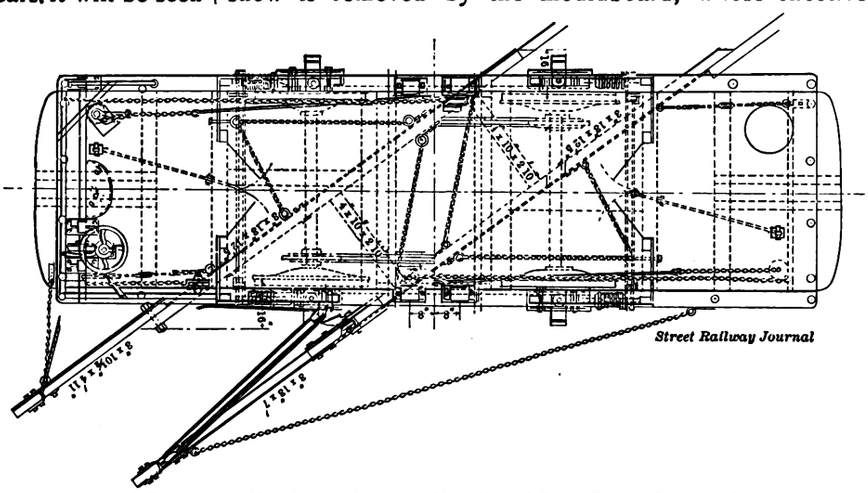

FIG. 8.—PLAN OF SNOW PLOW—BUFFALO STREET RAILWAY.

CAR HOUSES AND REPAIR SHOPS.

The car houses of the company are nine in number, and the repair pits in all the car houses are kept warm and dry by hot water pipes fed from boilers. The largest car house is that at Cold Spring Avenue, close to which are also located the repair shops and store house of the company. The shops consist of three departments, the first, a paint shop, employs eighteen men, the second, or carpenter's shop, nineteen men, and the machine shop,

which employs ten armature winders, twenty machinists, six blacksmiths and one foreman and ten boys in charge of wiring the cars. In the machine shop the company, besides making its own repairs, builds its own trucks, fenders, commutators and some other apparatus.

An ingenious method of recording the location of each car is employed by the master mechanic, and is shown in Fig. 9. It consists of a large board or panel about five feet high by ten feet wide. On the board are horizontal rows of brass hooks, and the board is divided into two divisions, one entitled "Cars in Service," the other "Cars in Shops." Each row of hooks under "Cars in Service" is lettered to represent a different division. The number of cars on that division is then shown by round pasteboard tags about one and a quarter inches in diameter, one of which is shown in Fig. 10 One side of this tag bears the number of the car, and on the other side is written the style of car body, style of truck, style of motor and style of controller. When a car is changed from one line to another the tag corresponding to the car is placed in its proper position on the board. If the car is in the car house, its tag is placed on a horizontal line reserved for this purpose.

The other half of the board entitled "Cars in Shops," has the following sub-heads: "Carpenter," "Paint," "Motor," "Wheels," "Trucks." These divisions indicate for what purpose the car is in the shop. Another vertical column is employed to show the location of the sweepers and snow plows.

ACCOUNTS.

In other departments as well the system of accounting has been carefully systematized, with the result of greatly simplifying the practical operation of the road, and in many cases of effecting direct economies in a number of directions. As a single instance of an immediate saving, which has resulted from a slight change in the method of making reports, we might mention that

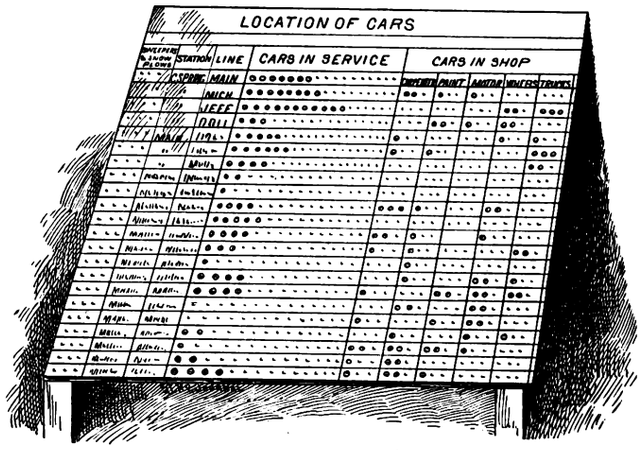

FIG. 9.—BOARD FOR RECORDING LOCATION OF CARS—BUFFALO STREET RAILWAY.

now in use by conductors in filling out their trip sheets. These are in form very similar to those in use on the other roads, and the time of arriving and leaving each terminus, with the number of cash fares, tickets, transfers, etc., received each trip is filled out by each conductor. At the bottom of the slip, however, is printed the following: Register Stood at Relief....., Date....., No of last transfer issued..... A space is also left for the *relief* conductor to sign and give his badge number, and also to punch the trip sheet. In this way each conductor checks the state of the registers of the preceding conductor and will, of course, not be apt to report the latter lower than it really is, because his own report of the state of the register upon commencing his duties must correspond to the closing number of the preceding conductor. No register takers are required by this system, resulting in the saving, upon a road the size of the Buffalo Railway, of about $40 per day.

STOREROOM.

The system of stores and storeroom accounting employed is most complete, and by it the cost of every article employed in any part of any work is readily determined. While it would be impossible in this article to describe fully the system, a brief sketch may not be without interest. Every variety of article in the storeroom is kept in a separate compartment, and each compartment

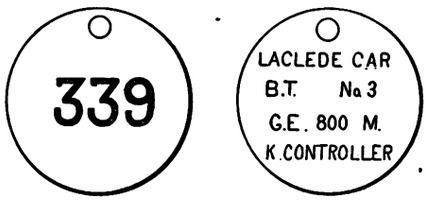

FIG. 10.—TAG FOR CAR BOARD—BUFFALO STREET RAILWAY.

is given a different storeroom or serial number. A list of these serial numbers is kept by the purchasing agent, so that if any article is needed by the storekeeper, the purchasing agent is advised by the number, and not by the name of the article. In this way no mistakes on account of differences in nomenclature can arise. Records of the material and labor employed in each department are kept very carefully, so that the amount expended upon any particular work can be readily determined.

The expense account is divided into a large number of appropriate headings, and each of these is carefully divided into proper sub-headings. The main headings are given numbers, and the sub-headings are designated by letters, so that in all reports these letters and numbers are used instead of the sub-headings themselves.

This system prevents any confusion from a difference in designating departments, and at the same time saves a great deal of time in entering the use of every article on the books, orders, etc., and a letter and a number only are required to designate any purpose to which any material is devoted.

HURRY-UP DEPARTMENT.

The hurry-up department is located at the Virginia Street car house, where are contained two tower wagons and a wrecking wagon for emergency service.

ORGANIZATION.

The officers of the company are: President, Henry M. Watson; vice-president and general manager, H. H. Littell; secretary and treasurer, Joseph S. Baecher; superintendent, F. O. Rusling.

The direct management of the affairs of the company is under the charge of Mr. Littell, to whom the reports of the various heads of the departments are made, and to whom the high efficiency to which the system has been brought has been largely due. When Mr. Littell assumed his duties in Buffalo less than four years ago the change from horse to electric power was commencing, so that the recent development of the system has been entirely under his supervision. He has had as wide an experience, and is probably as well known as any street railway manager in the country, and is recognized as an authority upon all matters relating to street railway practice.

The Street Railways of Hungary.

Statistics published by the Government in Hungary show that in that kingdom, on January 1, 1893, there were fifteen tramways, of which six are operated by horses, one by electricity, nine by steam and two by both steam and horse power. The total length of track was eighty-seven miles, and the number of cars 596. Of the latter 107 were freight cars, many of which were operated on the horse lines. The number of passengers carried by all of these lines was 33,062,672.